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कारतूस प्रकार के हीटिंग तत्व  
( गैर-एम्बेडेड ) — विशिष्टि  
( पहला पुनरीक्षण )

Cartridge Type Heating Elements  
(Non-Embedded Type) —  
Specification  
( First Revision )

ICS 621.315.551

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भारतीय मानक ब्यूरो  
BUREAU OF INDIAN STANDARDS  
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI-110002  
[www.bis.org.in](http://www.bis.org.in) [www.standardsbis.in](http://www.standardsbis.in)

## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the general safety requirements for cartridge type heating elements (non-embedded type) to ensure reliable operation, personal safety against electric shock and safety against the effects of excessive temperature and fire.

This standard was first published in 1966. This revision has been undertaken to upgrade the safety requirements in line with latest international practices.

Indian Standard, IS 302-1 on general and safety requirements for household and similar electrical appliances to which references have been made in this standard with regard to general and safety requirements as well as methods of tests is a necessary adjunct to this standard. Should, however, any deviation exist between the requirements of IS 302-1 and those of this standard, provisions of the later shall apply.

It has been assumed in the formulation of this standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the Indian accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features, which impair the level of safety, covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

This standard is to be read in conjunction with IS 302-1 'Safety of household and similar electrical appliance: Part 1 General requirements'. For the sake of convenience, the clauses of this standard corresponds to those of IS 302-1, instead of reproducing full text of each clause, clauses of IS 302-1 which are applicable (which means that relevant provisions of the clause apply) or not applicable and the sub-clauses or portion there of which are not applicable are indicated as under:

- a) In case of a clause where it is applicable, the wording used is 'this clause of IS 302-1 is applicable/not applicable'.
- b) In case of sub-clause or part thereof 'Not applicable'.

Wherever a sub-clause of IS 302-1 is to be replaced by a new text, it has been indicated as under:

Replacement – followed by the new text.

Any addition to the existing provision of a sub-clause of IS 302-1 has been indicated as under:

'Addition – followed by the text of the additional matter'.

Clauses/tables which are additional to those of IS 302-1 are numbered starting from **101** and additional sub-clauses are numbered with the main clause number followed by **101, 1.2**, etc, for example, **3.101**.

Should however, any deviation exist between IS 302-1 and this standard, the provision of the latter shall apply.

*(Continued on third cover)*

# *Indian Standard*

## CARTRIDGE TYPE HEATING ELEMENTS (NON-EMBEDDED TYPE) — SPECIFICATION

### (*First Revision*)

#### 1 SCOPE

This clause of IS 302-1 is replaced by the following:

This Indian Standard covers the safety requirements and methods of test for cartridge type heating elements (non-embedded type) for household and similar purposes intended for immersion heating units in conjunction with a sheath, designed to operate under specified operating conditions and meant for use in heating appliances, such as water heaters and their rated voltage being not more than 250 V.

NOTE—This standard does not apply to,

- a) solid embedded type electric heating elements (*see* IS 4158).
- b) mineral filled metal sheathed heating elements, (*see* IS 4159).
- c) mica insulated and ceramic bedded heating elements (*see* IS 6446), etc.

#### 2 REFERENCES

This clause of IS 302-1 is applicable except as follows:

##### 2.1 Addition

<i>IS No.</i>	<i>Title</i>
302-1	Safety of household and similar electrical appliances: Part 1 General requirements
3725: 1966	Specification for resistance wire, tapes and strips for heating elements
4158: 1985	Solid embedded type electric heating elements
4159: 2002	Mineral filled sheathed heating elements
6446: 1986	Mica insulated heating elements

#### 3 TERMINOLOGY

This clause of IS 302-1 is applicable except as follows:

**3.101 Cartridge Type Heating Elements** — Heating elements where the heating coils are laid through holes or channels provided in one or more formers and terminated in suitable metallic terminals provided in a base.

**3.102 Former** — Supports made of refractory materials with holes or channels provided for accommodating the heating coils.

**3.103 Base** — The piece of heat resisting and electrically

insulating material provided at one end of the heating element which provides the necessary terminals to which the ends of the heating coil are connected.

**3.104 Top** — The piece of heat resisting and electrically insulating material provided at the other end of the heating element to prevent contact between the heating coil and the sheath.

#### 4 GENERAL REQUIREMENT

This clause of IS 302-1 is applicable.

#### 5 GENERAL CONDITIONS FOR THE TESTS

This clause of IS 302-1 is applicable.

#### 6 CLASSIFICATION

This clause of IS 302-1 is not applicable.

#### 7 MARKING AND INSTRUCTIONS

This clause of IS 302-1 is applicable except as follows:

##### 7.1 Replacement

Heating elements shall be marked with the following:

- a) Rated voltage or rated voltage range, in volts;
- b) Symbol for nature of supply, unless the rated frequency is marked;
- c) Rated power input, in watts, or rated current, in amperes;
- d) Name, trade-mark or identification mark of the manufacturer or responsible vendor; and
- e) Country of manufacture.

##### 7.14 Replacement

Marking required by this standard shall be easily legible, durable and on the main part of the appliance or on wrapper/carton covering the heating element and the instructions leaflet.

The heating element may also be marked with the Standard Mark.

NOTE — The use of the Standard mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers and producers may be obtained from the Bureau of Indian Standards.

## **8 PROTECTION AGAINST ACCESS TO LIVE PARTS**

This clause of IS 302-1 is applicable only for heating elements with cover.

## **9 STARTING OF MOTOR-OPERATED APPLIANCES**

This clause of IS 302-1 is not applicable.

## **10 POWER INPUT AND CURRENT**

This clause of IS 302-1 is applicable.

## **11 HEATING**

This clause of IS 302-1 is applicable except as follows:

### **11.4 Addition**

Cartridge type heating element is placed in a vessel of appropriate shape containing a quantity of 2.0 to 2.5 litre per 100 W rated power input, the water being initially cold. Occasional addition of water to compensate the evaporation losses is recommended. Appliances are operated till the water temperature has reached to 95°C and is operated with stabilized water temperature.

## **12 VOID**

## **13 LEAKAGE CURRENT AND ELECTRIC STRENGTH AT OPERATING TEMPERATURE**

This clause of IS 302-1 is applicable.

## **14 TRANSIENT OVERVOLTAGES**

This clause of IS 302-1 is applicable.

## **15 MOISTURE RESISTANCE**

This clause of IS 302-1 is applicable.

## **16 LEAKAGE CURRENT AND ELECTRIC STRENGTH**

This clause of IS 302-1 is applicable.

## **17 OVERLOAD PROTECTION OF TRANSFORMERS AND ASSOCIATED CIRCUITS**

This clause of IS 302-1 is not applicable.

## **18 ENDURANCE**

**18.1** Cartridge type heating element shall be so designed that the risk of fire, mechanical damage impairing safety or the protection against electric shock as a result of abnormal or careless operation is obviated as far as is practicable.

## **19 ABNORMAL OPERATION**

This clause of IS 302-1 is applicable except as follows:

### **19.2 Addition**

Appliances are placed or hanged on the floor of the test corner for the most unfavorable position.

### **19.13 Addition**

A temperature rise of 100 K at terminals and 200 K on the walls and floor of the test corner are allowed.

## **20 STABILITY AND MECHANICAL HAZARDS**

This clause of IS 302-1 is not applicable.

## **21 MECHANICAL STRENGTH**

This clause of IS 302-1 is applicable.

## **22 CONSTRUCTION**

This clause of IS 302-1 is applicable except as follows:

**22.101** The formers shall be so designed as to permit proper aligning and to prevent their turning in relation to each other. However, a slight twist of the formers may be allowed to prevent sagging of the heating coil during operation.

**22.102** The former(s), base and top shall be made of such heat-resisting and electrically-insulating material which shall be able to withstand the thermal shocks normally encountered in service. All metallic parts shall be made of such materials as do not corrode when exposed to high temperature under normal use.

**22.103** The heating coils shall be so designed and supported that they maintain their intended positions without sagging in normal working condition.

**22.104** The channels shall completely enclose the heating element or where open channels are formed the opening shall be smaller than the coil diameter so as to prevent the heating coil falling out when a break or sag develops in the coil under normal use.

**22.105** The formers, base and top may be held together to form a complete cartridge by a center rod which will be made of metal.

**22.106** The bottom of the base shall end in a flange so that when the cartridge is slipped into a metal sheath of an internal diameter bigger than the diameter of the former, the flange alone stays outside resting on the edge of the sheath.

**22.107** The recommended diameters of the formers are 20 mm, 35 mm and 45 mm.

## **23 INTERNAL WIRING**

This clause of IS 302-1 is applicable.

**24 COMPONENTS**

This clause of IS 302-1 is applicable.

**25 SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CORDS**

This clause of IS 302-1 is applicable.

**26 TERMINALS FOR EXTERNAL CONDUCTORS**

This clause of IS 302-1 is applicable.

**27 PROVISION FOR EARTHING**

This clause of IS 302-1 is not applicable.

**28 SCREWS AND CONNECTIONS**

This clause of IS 302-1 is applicable.

**29 CLEARANCES, CREEPAGE DISTANCES AND SOLID INSULATION**

This clause of IS 302-1 is applicable.

**30 RESISTANCE TO HEAT AND FIRE**

This clause of IS 302-1 is applicable.

**31 RESISTANCE TO RUSTING**

This clause of IS 302-1 is applicable.

**32 RADIATION, TOXICITY AND SIMILAR HAZARDS**

This clause of IS 302-1 is applicable.

**101 TESTS****101.0 Categories of Tests**

Tests are classified as type, acceptance and routine tests.

**101.1 Type Tests**

The test specified in Table 101 shall constitute the type tests and shall be carried out on one sample of cartridge type heating element selected preferably at random from a regular production lot. Before commencement of the tests, the heating elements shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, construction, mechanical hazards, marking and provision of suitable terminals for supply connections. (Minor chipping of these parts in their new condition may be overlooked). Compliance shall be checked by visual inspection. The visual examination shall be repeated at the end of the type tests. The coil of the heating element shall not have sagged appreciably during test.

**Table 101 Schedule of Type Tests**

(Clause 101.1)

Sl No. (1)	Test (2)	Ref to Clause (3)
i)	Protection against access to live parts	8
ii)	Power input and current	10
iii)	Heating	11
iv)	Leakage current and electric strength at operating temperature	13
v)	Transient over-voltages	14
vi)	Moisture resistance	15
vii)	Leakage current and electric strength	16
viii)	Endurance	18
ix)	Abnormal operation	19
x)	Mechanical strength	21
xi)	Construction	22
xii)	Internal wiring	23
xiii)	Components	24
xiv)	Supply connection and external flexible cords	25
xv)	Terminals for external conductors	26
xvi)	Screws and connections	28
xvii)	Creepage distances and solid insulation	29
xviii)	Resistance to heat and fire	30
xix)	Resistance to rusting	31
xx)	Radiation, toxicity and similar hazards	32

**101.1.1 Criteria of Acceptance**

The sample shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, the testing authority, at its discretion, may call for fresh sample not exceeding twice the original number and subject them again to all tests or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test(s).

**101.2 Acceptance Test**

The following shall constitute the acceptance tests:

Test	Ref to Clause
a) Visual inspection	101.1
b) Power input and current	10
c) Construction	22
d) Heating	11
e) Leakage current	13
f) Moisture resistance	15

**101.3 Routine Tests**

The following shall constitute the routine tests:

Test	Ref to Clause
a) Visual inspection	101.1
b) Construction	22



(Continued from second cover)

The modifications between the existing version and the revision are given below:

- a) In abnormal operation the values of the temperature rise changed.
- b) Value of power input changed.
- c) Transient over-voltages included.
- d) Clearances, creepage distances and solid insulation included.
- e) Resistance to heat, fire and tracking included.
- f) Radiation, toxicity and similar hazards included.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

### BUREAU OF INDIAN STANDARDS

#### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones : 2323 0131, 2323 3375, 2323 9402

Website: [www.bis.org.in](http://www.bis.org.in)

#### Regional Offices:

	Telephones
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700054	{ 2337 8499, 2337 8561 2337 8626, 2337 9120
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019	{ 26 50206 265 0290
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 2254 1216, 2254 1442 2254 2519, 2254 2315
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 2832 9295, 2832 7858 2832 7891, 2832 7892

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